

Experimental formation of fine-grained rims around chondrules in dusty protoplanetary environments

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During planet formation within circumstellar disks, the manner in which dust coagulates is a critical step in the process, particularly in the growth of solids at the sub-millimeter to meter scales. Dust coatings, known as fine-grained rims (FGRs), have been observed on these bodies and are hypothesized to form from the accretion of nebular dust onto chondrules. FGRs are therefore a key element in the formation of the chondrite parent bodies, providing insight into their collisional history. Unfortunately, the mechanical evolution of FGRs remains poorly understood. While slow collision speeds are generally accepted to lead to the formation of chondrule rims, little experimental or theoretical attention has been given to the role of faster collisions or the role that charged dust might play in the overall formation process. This collision regime is important since Liffman (2019) recently suggested that high-speed collisions could produce ‘coatings’ on chondrule surfaces as a result of the fragmentation of impinging micron-sized grains. In this talk we report on recent experimental results collected within a dusty environment for an operating parameter space designed to better establish the FGR formation process required for either lower or higher speed particle / chondrule collisions. These results will be linked to both observed FGR characteristics and numerical models and then used to provide information on the nebular conditions that might have produced such fine-grained rims.

References

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